

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

IRRIGATION LAND LEVELING
(Ace)
CODE 464

DEFINITION

Reshaping the surface of land to be irrigated to planned grades.

PURPOSES

To permit uniform and efficient application of irrigation water to the leveled land.

CONDITIONS WHERE PRACTICE APPLIES

This standard applies to leveling irrigated land based on a detailed engineering survey, design, and layout. It does not include (462) Precision Land Forming or (466) Land Smoothing.

CRITERIA

Planned work shall comply with all Federal, State, and Local laws and regulations.

Land to be leveled shall be suitable for irrigation and for the proposed methods of water application. Water supplies and irrigation deliveries to the area to be leveled shall be sufficient to make irrigation practical for the crops to be grown and the irrigation water application method to be used.

Soils shall be deep enough so that after leveling an adequate, usable root zone remains that will permit satisfactory crop production with proper conservation measures. Limited areas of shallower soils may be leveled to provide adequate irrigation grades or a better field arrangement. The finished leveling work must not result in exposed areas of highly permeable materials that can inhibit proper distribution of water over the field.

All leveling work shall be planned as an integral part of an overall farm irrigation system to enhance the conservation of soil and water resources. The boundaries, elevations, and direction of irrigation of individual field leveling jobs shall be such that the

requirements of all adjacent areas in the farm unit can be met.

Field Grades - If more than one method of water application or more than one kind of crop is planned, the land must be leveled to meet the requirements of the most restrictive method and crop. All leveling work must be designed within the slope limits required for the methods of water application to be used, to provide for the removal of excess surface water, and to control erosion caused by rainfall. Reverse grades in the direction of irrigation shall not be permitted.

Slope for level irrigation methods - The maximum fall in the direction of irrigation shall not exceed one-half the design depth of application for a normal irrigation. The difference in elevation across an individual border strip shall not exceed 0.1-feet.

Slope for graded irrigation methods - The maximum slope in the direction of irrigation if rainfall erosion is not a significant problem shall be as follows:

1. Furrows - 3 percent;
2. Corrugations - 8 percent;
3. Borders for nonsod-forming crops, such as alfalfa or grain - 2 percent;
4. Borders for erosion-resistant grass or grass-legume crops or for nonsod-forming crops on sites where water application by the border method will not be required until after good crop stands have been established - 4 percent.

In areas where potential for rainfall erosion is great, the maximum slope for furrows shall be 0.5 percent and 2 percent for borders for sod forming grasses and 0.5 percent for other crops.

On slopes in the direction of irrigation of more than 0.5 percent where leveling designs provide for

increasing or decreasing slopes, the following limits shall apply:

- The maximum slope in irrigation run shall be no more than twice the minimum.
- The change in slope in any 100-foot reach shall not exceed one-half the maximum permissible change along the length of run. However, short level sections are permissible at the upper or lower ends of irrigation runs to facilitate water control or to reduce runoff.
- The maximum permissible slope change is the difference between the flattest and steepest design slope along the length of run.

Cross slope - The maximum cross slope for borders shall be 0.1 feet per border strip width.

The allowable cross slope for furrows and corrugations depends on the stability of the soil, the size of furrows that are to be used, and the rainfall pattern in the area. Cross slopes must be such that "breakthroughs" from both irrigation water and runoff from rainfall are held to a minimum.

Slope for subsurface irrigation methods - In areas where irrigation is practiced through ground water level control, the field surface shall be shaped to parallel the expected subsurface water elevations. The design shall consider the desired depth from the soil surface to the elevation of the ground water.

Surface drainage - Farm irrigation systems shall include plans for removing or otherwise controlling excess irrigation and storm water. Leveling designs must provide field elevations and field grades that will permit proper functioning of the planned drainage system facilities.

Maximum field elevation - All leveling work shall be designed to permit delivery of needed irrigating streams onto the highest point on the field surface. The field elevation shall be at least 0.33 feet below the water surface elevation at the point of delivery.

CONSIDERATIONS

In the design consider the excavation and fill material required for or obtained from such structures as ditches, ditch pads, and roadways. The appropriate yardage shall be included when balancing cuts and fills and determining borrow requirements.

Consider related structures and measures needed to control irrigation water and/or storm water runoff.

Consider crops, method of irrigation, soil intake rates, field slope, irrigation stream size and resulting deep percolation and runoff when determining or evaluating length of irrigation runs.

Consider the depth of cuts and the resulting available plant rooting depths to saline soils and to shallow water tables.

In areas with sediment-laden irrigation water, consider increasing the required height of the water surface at the point of delivery.

Consider effects on irrigation efficiencies, especially on volumes and rates of runoff, infiltration, evapotranspiration and deep percolation.

Consider effects on water flows and aquifers, and the affect to other water uses and users.

Consider the effects on adjacent wetlands.

Cultural Resources Considerations

NRCS's objective is to avoid any effect to cultural resources and protect them in their original location. Determine if installation of this practice will have any effect on any cultural resources.

Document any specific considerations for cultural resources in the design docket and the Practice Requirements worksheet.

GM 420, Part 401, the California Environmental Handbook and the California Environmental Assessment Worksheet provide guidance on how the NRCS must account for cultural resources. The Field Office Technical Guide, Section II contains general information, with Web sites for additional information.

Endangered Species Considerations

Determine if installation of this practice, along with any others proposed, will have an effect on any federal or state listed Rare, Threatened or Endangered species or their habitat. NRCS's objective is to benefit these species and others of concern, or at least not have any adverse effect on a listed species. If the Environmental Evaluation indicates that the action may adversely affect a listed species or result in adverse modification of habitat of listed species which has been determined to be critical habitat, NRCS will advise the land

user of the requirements of the Endangered Species Act and recommend alternative conservation treatments that avoid the adverse effects. Further assistance will be provided only if the landowner selects one of the alternative conservation treatments for installation; or at the request of the landowners, NRCS may initiate consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service and/or California Department of Fish and Game. If the Environmental Evaluation indicates the action will not affect a listed species or result in adverse modification of critical habitat, consultation generally will not apply and usually would not be initiated. Document any special considerations for endangered species in the Practice Requirements Worksheet.

Water Quantity

1. Effects on the water budget, especially on volumes and rates of runoff, infiltration evaporation, transpiration, and deep percolation;
2. Potential for a change in plant growth and transpiration because of changes in the volume of soil water;
3. Potential to manage irrigation water through root zone management.

Water Quality

1. Effects on erosion and the movement of sediment and soluble and sediment-attached substances carried by runoff;
2. Effects of nutrients and pesticides on surface and ground water quality;

3. Effects on the movement of dissolved substances below the root zone or to ground water;
4. Effects of water level control on the salinity of soils, soil water or downstream water;
5. Short-term and construction-related effects on the quality of downstream water courses;
6. Potential of uncovering or redistributing such toxic material as saline soil;
7. Effects on the visual quality of downstream water.

PLANS AND SPECIFICATIONS

Plans and specifications for irrigation land leveling shall be site specific and shall show the requirements for installing the practice to achieve its intended purpose. Site specifics typically include field boundaries, planned cuts and fills, earthwork volumes, cut/fill ratio, direction of irrigation, design down slope and cross slope, required water surface and location of irrigation water delivery, tailwater disposal, and appurtenant structures.

OPERATION AND MAINTENANCE

The maintenance on leveled fields includes the periodic removal or grading of mounds and/or depressions. Land grading may periodically be needed to restore the design gradient.